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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Jian Wu

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EXAMINER

GRAHAM, SAMUEL E

ART UNIT

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/780,177	Applicant(s) WU ET AL.	
	Examiner SAMUEL GRAHAM	Art Unit 2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02/16/2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6,9,10 and 13-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 24 is/are allowed.
- 6) ☐ Claim(s) 1-6,9,10 and 13-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>2/22/2005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed on 05/05/2008 has been entered. Claims 1, 9, 13, and 14-23 have been amended. Claim 24 has been added. Claims 7, 8, 11, and 12 have been canceled. Claims 1-7, 9, 10, and 13-24 are still pending in this application, with claims 1, 13, and 24 being independent.

Response to Arguments

Applicant's arguments with respect to claims 1-7, 9, 10 and 13-24 have been considered but are moot in view of the new ground(s) of rejection.

2. Applicant's arguments have been fully considered but they are not persuasive for the following reasons. The examiner respectfully disagrees with the application's interpretation of reference Arslan. On pages 7 and 8 of the applicant's response, applicant argues that Arslan does not teach the limitation "a numerator of the ratio that is a function of the clean speech value and the noise value" in the independent claims 1 and 13. In MPEP 2111, it states during patent examination, the pending claims must be "given their broadest reasonable interpretation consistent with the specification". *Arslan teaches that $P_s(\omega)$ represents an estimate for the speech power spectrum and is used in the numerator of the disclosed Wiener filter (column 11 lines 25-35).* More specifically, it would have been obvious to one of ordinary skill in the art that estimate for the speech power spectrum is derived from the input noisy speech signal composed

Art Unit: 2626

of a speech signal and noise inherent in the environment. As recognized by the applicant, $P_{\hat{y}}(\omega)$ is a representation of the noisy speech signal. Evident in within the definition of $P_{\hat{y}}(\omega)$, the noisy speech signal contains both noise and speech values. Further supporting the conclusion that the numerator contains clean and noisy speech values, Arslan further discloses $P_{\hat{s}}(\omega)$ to be $cP_{\hat{y}}(\omega)$ (Column 11, lines 35-45).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1- 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Acero* ("Environmental Robustness in Automatic Speech Recognition" IEEE 1990) in view of *Arslan* (5,706,395).

As per claim 1, *Acero* discloses a method of identifying a clean speech signal from a noisy speech signal, the method comprising:

receiving an observation vector representing a segment of a noisy speech signal (page 849-850, section 2, *a speech signal with uncorrelated additive noise*);

estimating a clean speech value and a noise value based on the observation vector (page 850, section 4, *an ML estimator is used to determine the noise vectors, then an MMSE estimator is used to estimate the uncorrupted (clean speech)vector*).

However, *Acero* does not disclose using the clean speech value and the noise value to set a gain for a filter, and applying the observation vector to the filter to produce a filtered clean speech vector representing a segment of a clean speech signal. *Arslan* discloses a system that uses a wiener filter for noise suppression. Using the wiener filter, spectral subtraction is performed using speech and noise estimates (column 11 lines 25-37), thus outputting clean speech. All of the claimed elements are disclosed in *Acero* and *Arslan*, and both techniques are used during speech normalization prior to speech recognition. The only difference is the combination of these known elements, i.e. using the method disclosed in *Acero* to estimate the clean and noise speech values, which are then used in the filter system disclosed in *Arslan*.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use the clean speech value and the noise value to set a gain for a filter, and apply the observation vector to the filter to produce a filtered clean speech vector representing a segment of a clean speech signal in *Acero*, since one of ordinary has good reason to pursue the options within his or her technical grasp in order to achieve the predictable result of developing a noise suppression system that is robust changing input, as indicated in both *Acero* (Abstract) and *Arslan* (column 11 lines 25-37 and lines 60-66).

Art Unit: 2626

As per claim 2, **Acero** in view of **Arslan** disclose the method of claim 1, and **Acero** further discloses wherein estimating a clean speech value and a noise value comprises using parameters that describe a distribution of noise values (page 850, section 4.2, *ML estimation of noise*).

As per claim 3, **Acero** in view of **Arslan** disclose the method of claim 2, and **Acero** further discloses comprising determining the parameters of the distribution of noise values (page 850, section 4.2, *ML estimation of noise*).

As per claim 4, **Acero** in view of **Arslan** disclose the method of claim 3, and **Acero** further discloses wherein determining the parameters of the distribution of noise values comprises determining the parameters based on multiple segments of the noisy speech signal (page 850, section 4.2, *ML estimation of noise*).

As per claim 5, **Acero** in view of **Arslan** disclose the method of claim 3, and **Acero** further discloses wherein determining the parameters of the distribution of noise values comprises determining a mean of the distribution of noise values using an iteration (page 850, section 4.2, *ML estimation of noise*).

Art Unit: 2626

As per claim 6, *Acero* discloses the method of claim 5, and *Acero* further discloses wherein determining a mean of the distribution of noise values using an iteration comprises at each iteration updating the mean by adding a value to the value of the mean in a past iteration, the value added to the mean not being computed based on a product formed between a covariance of the noise distribution and a difference between the observation vector and another value (page 850, section 4.2, *the EM algorithm is used to obtain ML solutions*).

As per claim 9, *Acero* in view of *Arslan* disclose the method of claim 7, however *Acero* does not disclose wherein defining the gain as a ratio comprises defining the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive. *Arslan* discloses wherein defining the gain as a ratio comprises defining the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive (column 11 lines 25-37).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to define the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive in *Acero*, since one of ordinary skill in the art has good reason to pursue the options within his or her technical grasp in order to achieve the predictable result of designing a robust noise suppression filter.

Art Unit: 2626

As per claim 10, **Acero** in view of **Arslan** disclose the method of claim 1, and **Acero** further discloses wherein the observation vector has been formed without applying a frequency-based transform (Abstract, *the technique uses cepstral vectors*).

As per claim 13, **Acero** discloses a computer-readable medium having computer-executable instructions for performing steps comprising:

obtaining an estimate of a clean speech value and an estimate of a noise value derived from a noisy speech signal (page 850, section 4, *an ML estimator is used to determine the noise vectors, then an MMSE estimator is used to estimate the uncorrupted (clean speech) vector*);

However, **Acero** does not disclose setting a numerator of a filter gain ratio as a function of the clean speech value and the noise value, setting a denominator of the filter gain ratio as a function of the clean speech value and the noise value, and using the filter gain ratio in a filter that is applied to the noisy speech signal. **Arslan** discloses using a wiener filter for noise suppression, where the gain ratio is defined as a ratio with the numerator as a function of the clean speech and noise value (column 11 lines 25-35, *the filter gain numerator is an estimate of the input speech signal, which is a function of the clean and noisy speech*), and the denominator is the sum of the clean speech value and the noise value (column 11 lines 25-35).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to set a numerator of a filter gain ratio as a function of the clean speech value and the noise value, set a denominator of the filter gain ratio as a function of the clean speech value and the noise value, and use the filter gain ratio in a filter that is applied to the noisy speech signal in

Art Unit: 2626

Acero, since one of ordinary skill in the art has good reason to pursue the options within his or her technical grasp in order to achieve the predictable result of designing a robust noise suppression filter.

As per claim 14, this claim recites limitations similar to those recited in claim 2, and is therefore rejected for similar reasons.

As per claim 15, this claim recites limitations similar to those recited in claim 3, and is therefore rejected for similar reasons.

As per claim 16, this claim recites limitations similar to those recited in claim 4, and is therefore rejected for similar reasons.

As per claim 17, *Acero* in view of *Arslan* disclose the computer-readable storage medium of claim 16, and *Acero* further discloses wherein determining the parameter comprises determining a mean iteratively, wherein each iteration utilizes an update equation that is formed by maximizing the joint probability of a sequence of observation vectors and a sequence of mixture component indices (page 850, section 4.2, *ML estimation of noise*).

Art Unit: 2626

As per claim 18, ***Acero*** in view of ***Arslan*** disclose the computer-readable storage medium of claim 13, and ***Acero*** further discloses wherein obtaining an estimate of a clean speech value and an estimate of a noise value comprises estimating a cepstral clean speech value and a cepstral noise value in a cepstral domain and converting the cepstral clean speech value and the cepstral noise value into the spectral domain to produce a spectral domain clean speech value and a spectral domain noise value (Abstract and Figure 1, *speech and noise vectors are cepstral vector, and Figure 1 displays the speech and noise spectrum from the stereo database. Therefore it is inherent the cepstral values are converted to spectrum values*).

As per claim 19, ***Acero*** in view of ***Arslan*** disclose the computer-readable storage medium of claim 18, however ***Acero*** does not disclose wherein obtaining an estimate of a clean speech value and an estimate of a noise value further comprises smoothing the spectral domain clean speech value and the spectral domain noise value across frequencies. ***Arslan*** discloses smoothing prior to filtering by the wiener filter (column 8 lines 14-40).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to smooth the spectral domain clean speech value and the spectral domain noise value across frequencies in ***Acero***, since it reduces noise fluctuations in the filtered speech signal, as indicated in ***Arslan*** (column 8 lines 25-28).

As per claim 20, ***Acero*** in view of ***Arslan*** disclose the computer-readable storage medium of claim 18, however ***Acero*** does not disclose wherein obtaining an estimate of a clean speech value

Art Unit: 2626

and an estimate of a noise value further comprises smoothing the spectral domain clean speech value and the spectral domain noise value across time. *Arslan* discloses smoothing prior to filtering by the wiener filter (column 8 lines 14-40).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to smooth the spectral domain clean speech value and the spectral domain noise value across frequencies in *Acero*, since it reduces noise fluctuations in the filtered speech signal, as indicated in *Arslan* (column 8 lines 25-28).

As per claim 21, *Acero* in view of *Arslan* disclose the computer-readable storage medium of claim 13, and *Acero* further wherein obtaining an estimate of the noise value comprises utilizing a parameter that describes a distribution for a residue error (page 850, section 4.2, *ML estimation of noise*).

As per claim 23, this claim recites limitations similar to those recited in claim 9, and is therefore rejected for similar reasons.

Allowable Subject Matter

1. Claim 24 is allowed. The following is an examiner's statement of reasons for allowance: determining a covariance of a residue error without using stereo training data. All other limitations are taught in prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

3. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAMUEL GRAHAM whose telephone number is (571)270-5360. The examiner can normally be reached on Monday-Thursday, 7:00 - 4:30, Alt Friday, EST.

Art Unit: 2626

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Edouard can be reached on (571) 272-7603. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SG/

/Patrick N. Edouard/
Supervisory Patent Examiner, Art Unit 2626